



**Facultad de Ciencias Económicas y Empresariales**

**TRABAJO FIN DE GRADO  
EN GRADO EN ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS,  
PROGRAMA INTERNACIONAL**

**PERFORMANCE PERSISTENCE IN THE SPANISH DEFINED  
CONTRIBUTION PENSION PLANS**

**Eduarne Urricelqui Goñi**

**DIRECTOR**

**Rafael Santamaría Aquilué**

**Pamplona-Iruña**

**JUNIO 2017**

## INDEX

1. INTRODUCTION.....	6
1.1. Origin and evolution.....	6
1.2. Basic principles .....	10
1.3. Definitions.....	11
1.4. Pension plan ending.....	14
2.1. Classification .....	15
2.2. Categories .....	17
3. DIFFERENCES BETWEEN INDIVIDUAL AND OCCUPATIONAL PENSION PLANS .....	18
4. PREVIOUS LITERATURE.....	20
4.1. Mutual funds .....	20
4.2. Pension funds.....	22
5. OBJECTIVE.....	24
6. DATABASE.....	25
6. METHODOLOGY AND PERFORMANCE MEASURES .....	27
6.1. Jensen's alpha.....	28
6.2. Treynor's ratio.....	28
6.3. Sharpe's ratio.....	29
7. METHODOLOGY AND PERSISTENCE MEASURES .....	30
7.1. Chi-squared test by Carpenter and Lynch .....	30
7.2. CPR (Cross-Product Ratio).....	31
8.1. Individual pension plans.....	31
8.1.1. <i>Raw returns performance persistence study in individual pension plans</i> .....	31
8.1.2. <i>Risk-adjusted performance persistence study of individual pension plans</i> .....	36
8.2. Occupational pension plans.....	39
8.2.1. <i>Raw returns performance persistence study in occupational pension plans</i> .....	39
8.2.2. <i>Risk-adjusted performance persistence study of individual pension plans</i> .....	42

9. LIMITATIONS .....	45
10. CONCLUSIONS .....	46
11. REFERENCES .....	47

## INDEX OF FIGURES AND TABLES

Fig. 1 Evolution of the participant's account. ....	9
Fig. 2 Evolution of the number of pension plans.....	9
Fig. 3 Evolution of the number of pension plans, number of participants and their average size (measured in millions of euros) from 2006-2015. ....	16
Table 1 Number of Pension Plans. Source: General Directorate of Insurance and Pension Funds. ....	9
Table 2 Contributions to Pension Plans. Source: General Directorate of Insurance and Pension Funds. ....	10
Table 3 Distribution of Spanish pension funds' assets in 2005 (% of total assets invested). Source: General Directorate of Insurance and Pension Funds.....	10
Table 4 Different ways of receiving the benefits during 2007-2015. (% of the total benefits obtained). Source: General Directorate of Insurance and Pension Funds.....	13
Table 5 Types of pension plans according to their promoters and participants. Source: INVERCO.....	15
Table 6 Types of pension plans according to their obligations and constituents. Source: INVERCO.....	17
Table 7 Categories of pension plans according to their type of assets invested. Source: INVERCO.....	18
Table 8 Median values of the raw-returns obtained by mixed fixed income individual pension plans from 2008-2014 (%). ....	33
Table 9 Median values of the raw-returns obtained by mixed variable income individual pension plans from 2008-2014 (%). ....	33
Table 10 Results from the Chi-squared test in MFI individual pension plans (raw-returns). ....	34
Table 11 Results from the Chi-squared test in MVI individual pension plans (raw-returns). ....	34
Table 12 Results from the CPR test in MFI individual pension plans (raw-returns).....	35
Table 13 Results obtained after performing CPR analysis in MFI individual pension plans (raw-returns). ....	35
Table 14 Median values of the risk-adjusted returns of MFI individual pension plans from 2008-2014. (%). ....	36

Table 15 Median values of the risk-adjusted returns of MVI individual pension plans from 2008-2014. (%).....	36
Table 16 Results of the Chi-squared test in MFI individual pension plans using risk-adjusted returns. ....	37
Table 17 Results of the Chi-squared test in MVI individual pension plans using risk-adjusted returns. ....	37
Table 18 Results obtained after performing CPR analysis in MFI individual pension plans using risk-adjusted returns. ....	38
Table 19 Results obtained after performing CPR analysis in MVI individual pension plans using risk-adjusted returns. ....	38
Table 20 Median values of the raw-returns of MFI occupational pension plans from 2008-2014. (%).....	39
Table 21 Median values of the raw-returns of MVI occupational pension plans from 2008-2014. (%).....	39
Table 22 Results of the Chi-squared test developed in MFI occupational pension plans (raw-returns). ....	40
Table 23 Results of the Chi-squared test developed in MVI occupational pension plans (raw-returns). ....	40
Table 24 Results of the CPR analysis performed in MFI occupational pension plans (raw-returns).....	41
Table 25 Results of the CPR analysis performed in MVI occupational pension plans (raw-returns).....	42
Table 26 Median values of risk-adjusted returns obtained from MFI occupational pension plans from 2008-2014. (%).....	42
Table 27 Median values of from the risk-adjusted returns got from MVI occupational pension plans from 2008-2014. (%).....	43
Table 28 Results of Chi-squared test performed in MFI occupational pension plans considering risk-adjusted returns.....	43
Table 29 Results of Chi-squared test performed in MVI occupational pension plans considering risk-adjusted returns.....	43
Table 30 CPR results of the analysis performed in MFI occupational pension plans using risk-adjusted returns. ....	44
Table 31 CPR results of the analysis performed in MVI occupational pension plans using risk-adjusted returns. ....	45

## **ABSTRACT**

The aim of this paper is to analyse if performance persistence exists in Spanish individual and occupational pension plans from 2008 to 2014. The examination was done from a mid and long-term point of view. A sample of mixed fixed and variable income pension plans was studied. Data was taken from General Directorate of Insurance and Pension Funds, INVERCO and Bank of Spain webpages. Chi-squared and Cross-Product-Ratio (CPR) were used to test the performance persistence and it was carried out using raw and risk-adjusted returns, with the aim of getting higher robustness in the results. The results show evidences that allow us to conclude the existence of persistence in occupational pension plans, but it is less likely to occur in individual ones. The main reason which explains the different results is the influence of the control commission. In the first scenario, commission control does defend participants and beneficiaries' interests, so the management firm has to manage pension plans in order to achieve the best returns in each of the period. The higher fees applied to individual pension plans could also explain the worse performance.

## **KEY WORDS**

Pension plans, persistence, performance, MFI, MVI

# 1. INTRODUCTION

## 1.1. Origin and evolution

Nowadays, there is high uncertainty related to the future of retirement public pensions' earnings. It could be caused by the changes in demographic rates, which will be explained in the following paragraphs.

According to Jimeno (2002), the main causes of population aging are the increase in the life expectancy, the reduction of the birth rate and immigration. "Although it is uncertain how these demographic variables might develop in the future, it appears inevitable that the ratio between the sizes of older and younger cohorts will increase noticeably during the first half of this century". (The Spanish Pension System: Issues of Introducing NDCs. p.5). Montero (2000) analyses the effects that the progressive aging of the population will have on financing social security in Spain. She confirms that if current contribution rates remain constant, the government will not be able to guarantee future retirees, the current levels of pensions.

Therefore, people started to consider a long-term complementary alternative: private pension plans. That is why they have experienced a boom during the last decades.

Pension plans are defined by INVERCO as "long-term saving products, which people decide to sign voluntarily, whose main aim is fulfilling determined contingencies, especially retirement". However, they could be used for other contingencies, such as, survivorship, long-term unemployment, orphan hood or disability. Moreover, an article written by Galán and Del Diego (2014) mentions that, "the government is considering increasing the number of situations when it is possible to retrieve the money from the pension fund in order to stimulate the use of these investment vehicles." (pp.3)

The benefits obtained must always act as a complement to the ones obtained by compulsory public pension plans. The rents received will vary depending on the return, risk and the particular contribution.

Taking into account their characteristics, they are joined in different pension funds which are defined by INVERCO as "separated assets without legal personality which are created in order to fulfil the objectives offered by the pension plans which belong to them. They consist on the contributions of the investors and their returns generated". They are managed by some management entities which try to obtain the highest returns. One of the

first management companies of pension funds and plans was Ibercaja. The most common situation is that the pension funds include just one pension plan.

The first pension plan appeared in 1988, when it was being implemented the first parametric reform of the public pay-as-you-go system. Since this moment, Spanish authorities have been trying to foster supplementary pension provision. Government was trying to incentivize them because of these two reasons:

- 1) They allow inhabitants to save more money that they could use when they would retire.
- 2) Long-term savings benefit country's economy because it allows the growth of capital markets and improves companies' and countries' financing.

What is more, they were a good option for the population because their participants or beneficiaries can enjoy the following advantages:

- Fiscal benefits. There are two types: one related to the contributions of the participants because they can be deducted from the personal income tax base and the other regarding zero-rate applied to the corporation tax.
- Participants can manage their own investments
- Illiquidity. This means that they encourage the creation of a saving discipline.

Marti and Matallín (2008) mention other possible explanations like these ones:

- 1) The transparency of information, not only before investing in the plan but also during the period in which the returns are obtained.
- 2) Flexibility according to the contributions.
- 3) The type of investment to be chosen or the guarantee that the plan is managed by entities which are specialists in this subject and which are also supervised by a superior entity: General Directorate of Insurance and Pension Funds (Ministry of Economy).
- 4) Professional management. It implies that the managing entity will follow the evolution of the markets and financial assets they trade with, and they will ensure the appropriate diversification of these assets in their portfolio composition. From this perspective, the participant may be able to obtain a higher level of security and return on his or her investment.

From Anton et al (2014) point of view, the fiscal benefit is the main reason of its popularity, because they mean a huge fiscal saving for the participants. Actually, the lower the income earned after being retired, the higher their fiscal benefit.



First of all, we have to mention that the compensations acquired by the pension plan are treated in the same way as labour rents.

Galán and Del Diego (2014) explain how the fiscal benefit is obtained. Before the retirement, the contributions to the pension plan are deducted from the personal income tax base. When the beneficiary would be retired, they should pay the taxes taking into consideration the benefits they received from the pension plan. That is why, it is said that the benefits of the fiscal savings which are mainly related to personal income tax are paid back during the retirement period. However, it is not totally true, because as the income is lower than the one earned while they were working, the amount of taxes paid is also lower. The higher the labour income and the contributions, the higher the fiscal advantage.

However, the benefit is limited by some restrictions which differ depending on the region. For instance, the law applied in Navarre is different to the one of the rest of Spain. In addition, the limits have changed a lot since pension plans were created. When the rents would be materialized in a capital way (a unique quota), it is advisable to get it in the next periods after being retired, but not in the one when you are being retired. Otherwise, the fiscal benefit could not take place.

Regarding the zero-rate applied to the corporation tax, it benefits occupational pension plans because the contributions made by the promoters of these plans in favour of their workers could be deducted from the tax base

The last advantage regarding pension funds is that they are exempted from paying “*Impuesto sobre transmisiones patrimoniales y actos jurídicos documentados*” when there is modification in the assets included in that fund.

Due to their advantages and the incentives of the government, we can see a huge increase since its creation, what it is denominated as “the boom”. However, since 2010, the number of participants decreased. It could be due to the economic crisis. As people were suffering economic problems, they needed that money to face their daily-needs rather than investing it thinking about their future ones.

In figure 1, we can see the evolution of the participant’s accounts between 1993 and 2015.

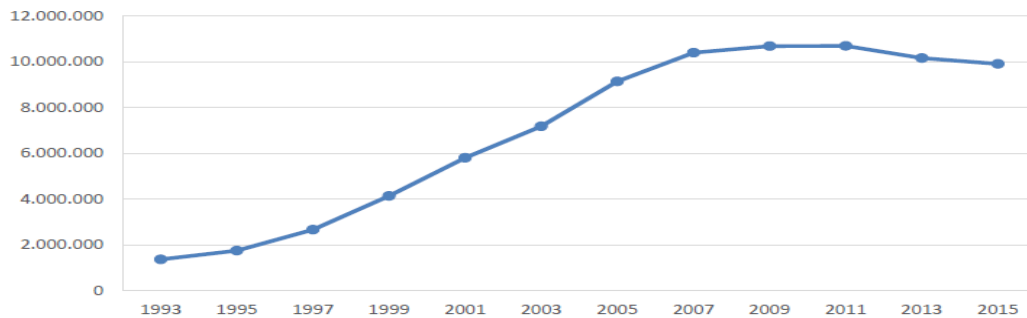


Fig. 1 Evolution of the participant's account. Source: General Directorate of Insurance and Pension Funds.

In figure 2, it is shown their evolution during 2007-2015 and it can be seen the reduction since 2010. Occupational pension plans are represented in blue, associated ones in red and green makes reference to individual pension plans.

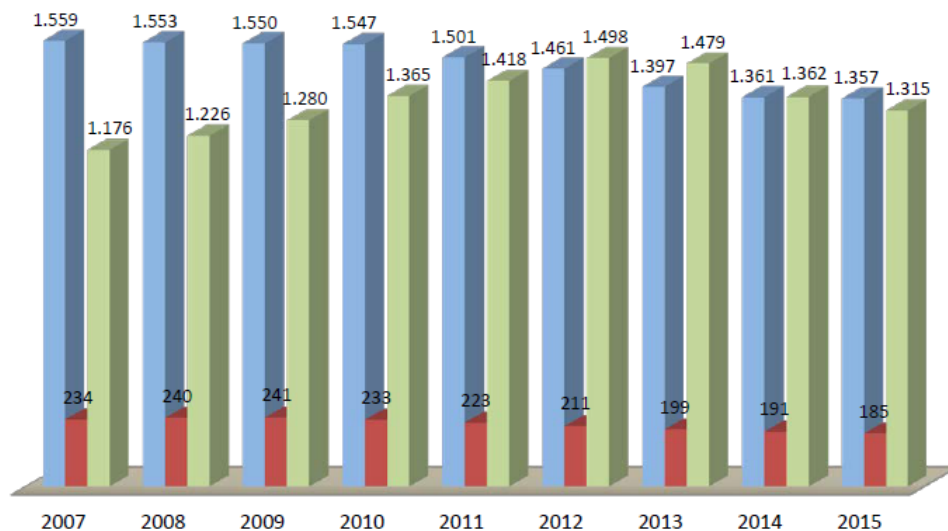


Fig. 2 Evolution of the number of pension plans. Occupational pension plans are represented in blue, associated ones in red and green makes reference to individual pension plans. Source: General Directorate of Insurance and Pension Funds.

In table 1, we can see the aggregation of all the pension plans in each of the years included in the study period. This allows us to see their evolution globally.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	2969	3019	3071	3145	3142	3170	3075	2914	2857

Table 1 Number of Pension Plans. Source: General Directorate of Insurance and Pension Funds.

This fact affected to the plans' contributions as we can observe in the table 2. It displays information about the contributions to pension plans in millions of € from 2010 to 2015. Pension plans have decreased since 2010 in all the cases.

CONTRIBUTIONS		2010	2011	2012	2013	2014	2015
<b>Occupational plans</b>	Job	1651	1642	1314	1131	1100	1130
	Management entity contributions	1443	1427	1115	933	889	920
	Participant contribution	208	215	199	198	211	209
<b>Associated plans</b>		41	31	27	29	32	24
<b>Individual plans</b>		3738	3237	2822	2960	3464	3277

Table 2 Contributions to Pension Plans. Source: General Directorate of Insurance and Pension Funds.

In order to evaluate the importance of Spanish pension plan, we could compare it with some data from Europe. Taking into account this information, we can conclude that the money invested is not very high. Its investment just represents 9.6% of the total GDP while in other countries like Netherlands or Iceland, it represents 176.4% and 148% of the total GDP, respectively. (Informe estadístico DGDS 2005).

The distribution of Spanish pension funds' assets is exposed in table 3. The data is from 2015.

	Shares	Fixed income	Deposits and liquid assets	Others
<b>Spain</b>	11,4%	62.4%	16.7%	9.4%

Table 3 Distribution of Spanish pension funds' assets in 2015 (% of total assets invested). Source: General Directorate of Insurance and Pension Funds.

After having introduced some general aspects of pension plans, we are going to analyse the topic a little bit more into.

## 1.2. Basic principles

In the law of pension funds and plans are described 5 different principles that any pension plan must respect:

- a) No discrimination. This means that anyone who wants to be participant of a pension plan must have access to get its aim if they fulfil the requirements specified by the promoter to sign that type of contract.
- b) Capitalization. Pension plans are instrumented through capitalization systems which could be financial or actuarial. In consequence, their benefits will be defined by those systems.
- c) The contributions which are done cannot be revoked.
- d) Rights attribution. The contributions which are made to pension plans will allow the participants to enjoy some economic rights which represent the compensations they will receive when the contingency arises.
- e) Compulsory integration to a pension fund. Any resource which is assigned to the pension plan must be integrated in a pension fund, following pension and funds plans' law.

### **1.3. Definitions**

Finally, we will mention some concepts which are relevant for the topic

- Contributions

They are the assets invested in the pension plan. They can be done by the participant or by the promoter of an employment plan and they are restricted to 8000€ per year<sup>1</sup> with some exceptions in the case of employment plan.

- Contingencies

They represent the reason why the plan has been created. They can be:

- Retirement
- Disability
- Death of the participant or beneficiary which can create widow's/widower's pension, orphanage or heritage pension
- Serious dependency or high participant dependency

Retirement and disability pensions are determined by the Social security regimen.

In addition, the most common of them is the first one taking place in more than 77% of the situations.

---

<sup>1</sup> This is the current limit according to Spanish Law. However, it can be different in other autonomous communities. Moreover, it has changed several times since it was established.

- Consolidated rights

They include the contributions and the returns obtained by the investment. However, the expenses that have been generated during the period should be deducted from this amount.

In the case of defined contribution one, their quota is determined by the contributions, returns and expenses of the plan. On the other hand, in the case of a defined benefit, the right is related to the reserve stated in the actuarial system.

They could be effective, in exceptional cases like severe illness or long-term unemployment, if it is allowed by the plan specifications.

They cannot be frozen or used in judged issues until they are effective.

- Benefits

They are defined by the General Directorate of Insurance and Pension Funds (2005) in its report: as “the economic right which will receive the beneficiary of the pension plan when the contingency for which they have been created takes place. The exception would be that they have been frozen or restricted due to administrative or judged matters”. (Informe Estadístico de Instrumentos de Previsión Social Complementarias, pp. 54)

In the case of beneficiary's death, the quantity can be received by other people by different regular payments or the total quantity by once.

Before creating the plan, the dates for receiving or investing the money are defined. However, they can be changed if the pension plan allows it.

A relevant issue to be considered is that it is incompatible the fact of receiving the benefits and still contributing to the plan. If the contingency of the pension plan takes place or they are received the consolidated rights, the beneficiary will get the compensations and they do not have to do more investments.

We can distinguish 4 ways of receiving the benefits:

- 1) Capital benefits. It consists on the reception of a single payment.
- 2) Rent benefits which could be temporary or permanent.
- 3) Mixed benefits which represent a combination of the two latter.
- 4) Others, different from the previous ones which don't include regular payments.

In table 4 are exhibited how the benefits were received during 2007-2015, in percentage. As it can be seen, the most common way of obtaining the benefits is the capital one.

Collection ways (%)	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Capital</b>	65.5	60.4	66.2	59.2	57.6	55.4	53.1	47.1	48.5
<b>Rent</b>	27.6	33.8	27.4	24.4	26.3	27.9	30.9	31.4	28.6
<b>Mixed</b>	6.9	5.3	6.2	16	15.7	16.1	15.2	20.5	21.8
<b>Others</b>	-	0.5	0.2	0.4	0.4	0.6	0.8	0.9	1.1

Table 4 Different ways of receiving the benefits during 2007-2015. (% of the total benefits obtained). Source: General Directorate of Insurance and Pension Funds.

- **Components of fund and pension plans.**

- Advocate of participants and beneficiaries

It only exists in the individual pension plans. Their function is helping the participants and beneficiaries if they could have any problem, doubt or complaint.

- Control Commission

It represents the interests of the participants and beneficiaries.

- Custody and management entity

Management entities should control and manage pension funds with the help of the custody one. They are compulsory elements because pension funds are not legal entities, so they cannot be managed by themselves. In the case of insurance companies, they should be previously authorized to develop management activity, but there are other types of entities which can be managers of the plan.

They have the control of organizing administrative and accountancy issues of the pension fund properly, so they need human and technical means and an appropriate internal control. For example, they control the accounting of the fund, or they have to write the instructions for transferring rights.

Custody organizations are credit entities whose residence has to be in Spain or one of its subsidiaries should be settled there. In addition, they have to be registered in the General Directorate of Insurance and Pension Funds as a custody entity. With respect to their functions, they have to develop different activities like receiving,

having the safekeeping and deposit of the fund assets or controlling that managing companies fulfil their obligations.

Both receive commissions due to their tasks. The maximum commissions per year are 1.5% (management) and 0.25% (deposit) which are applied to the account value. They affect to the pension plan, to the pension fund and to each participant and beneficiary.

This limit was fixed in 2014 by the government in order to give advantages to the public and it meant a saving of around 121 million of euros per year. It was established because it was thought that some of the reasons of the low return from Spanish plans were that the commissions applied were too high.

#### **1.4. Pension plan ending**

Pension plan could finish due to the following reasons:

- a) It does not fulfil its basic principles.
- b) In the case of associated and occupational plans, because of the standstill of the commission control.
- c) Unfulfillment of the planned measures established in a sanitation or financing pension plan.
- d) Inability of performing the needed changes which has been proposed after an inspection.
- e) When there are not participants or beneficiaries during a period longer than a year.
- f) Dissolution of the promoter. If this fact is due to a merge or a transfer of assets to another promoter, the plan will not be affected.
- g) When the commission control of an occupational plan decided to introduce pension plans' agreements in a Social Business prevision one.
- i) Other possible cause that is stated in the specifications of the pension plan.

If the pension plan finishes due to the previous reasons, there is a guarantee and continuity law in which the assets invested could continue in another pension plan, so individual benefits and their consolidated would still be received by their owners.

## 2. CATEGORIES AND TYPES OF PENSION PLANS

### 2.1. Classification

The different factors that are used to define the different kind of funds and pension plans are the following: 1) Constituents; 2) Duties; 3) The investment process that can be followed by pension funds.

#### 1) CONSTITUENTS

The constituents can be:

- a) The promoter. It could be any company, entity, corporation, association or trade union which is the responsible of the creation of the pension plan or that it would make possible its development.
- b) Participants. Individuals who are interested in the creation of the plan, regardless they make contributions to it or not.
- c) Beneficiaries. Individuals who will receive the benefits of the pension plan, without taking into account if they are participants or not.

According to this characteristic, the law regarding pension funds and plans published in BOE, defines three types of pension plans: occupational, associated and individual ones.

Table 5 shows the different promoters and participants of the pension plans.

PLAN		
Type	Promoter	Participants
Occupational system	Firm, civil associations, corporation or entity	Employees from the promoter
Associated system	Organization or trade union	Partners, members or affiliated
Individual system	Financial entity	Individuals

Table 5 Types of pension plans according to their promoters and participants. Source: INVERCO.

In figure 3, is illustrated the number of plans (blue), the number of participants (green) and their average size measured in millions of euros (red) during the period, 2006-2015. From the left to the right, the first graph is referred to occupational, the next figure shows individual ones and finally associated plans.



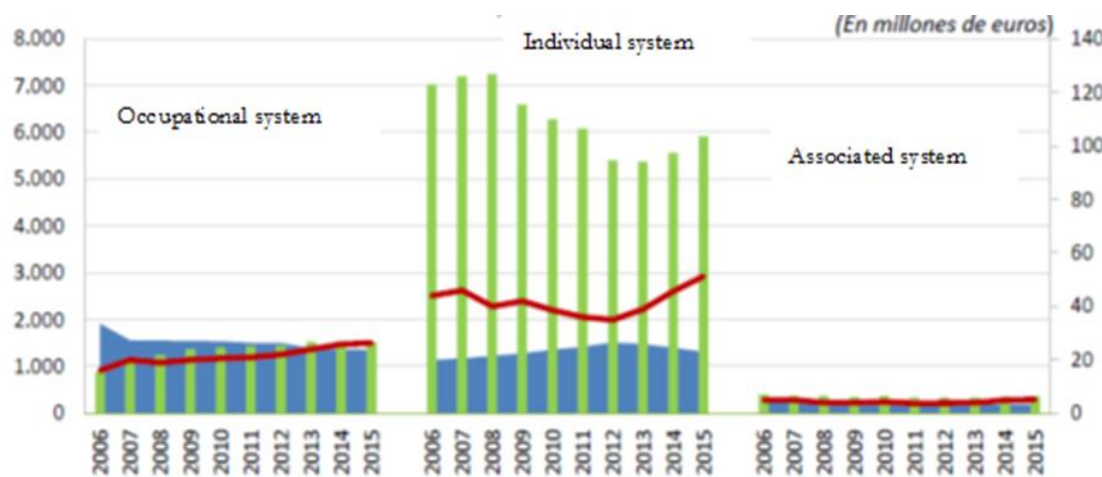


Fig. 3 Evolution of the number of pension plans (blue), number of participants (green) and their average size (measured in millions of euros: red) from 2006-2015. From the left to the right, the first graph refers to occupational pension plans, the second, to individual ones and the last one to associated pension plans. Left vertical axis: number of pension plans and participants; right vertical axis: millions of euros and horizontal axis: time. Source: General Directorate of Insurance and Pension Funds.

## 2) DUTIES

With respect to this issue, the law regarding pension funds and plans differentiates three different plans.

a) **Defined contribution plans** in which it is previously defined the contribution from the participants or those from the promoters, but they are unknown and unguaranteed future benefits.

The contributions could be fixed according to different issues such as the salary or *business benefits*.

The benefits will be received when the contingency takes place or when it is put in practice the capitalization process. In the first case, it could be fixed the benefits that will be earned.

b) **Defined benefit plans** in which it is predetermined the quantity that will receive the beneficiary. They also included the ones whose aim is granting some compensation through financing mechanisms.

As in the previous case, the output could depend on other factors like the salary.

c) **Mixed plans** in which it can be defined, simultaneously or separately, the contribution or de quantity to be received.

In this category are included pension plans which do not fulfil completely all the requirements explained in a) and b).

1<sup>st</sup> Pension plans which require a defined quantity contribution but they also guarantee getting a minimum interest benefit.

2<sup>nd</sup> The ones which define the quantity to be provided, but they also ensure a determined interest rate.

3<sup>rd</sup> The plans which include a defined contribution quantity for a determined contingency, and a defined benefit for other kind of contingency.

Combining the first classification with the current one, it has to be highlight that occupational and associated system could belong to any of the categories explained. However, individual ones can only be classified as defined contribution one. This can be seen in table 6.

Type of plan	
According to OBLIGATIONS	According to CONSTITUENTS
Defined benefit and mixed plans	Occupational and associated system
Defined contribution	Occupational and associated system
	Individual system

Table 6 Types of pension plans according to their obligations and constituents. Source: INVERCO.

### 3) INVESTMENT PROCESS FOLLOWED BY PENSION FUNDS.

According to the law of pension funds and plans, this characteristic allows us to classify pension funds into

a) **Closed pension funds** are the ones which just managed financial assets from the pension plans which belong to that pension fund.

b) **Open pension funds** are the ones which administer not only the assets from the pension plans which belong to them, but also the ones from pension plans which are part of another pension fund. However, there are two restrictions: 1) the pension fund should belong to the same category and 2) the total assets from the fund should be higher than 12 million of euros.

## **2.2. Categories**

As it can be seen in table 7, pension plans can be divided into 5 categories according to the type of assets that could be invested.

<b>PENSION PLANS' CATEGORIES</b>	
<b>Fixed income</b>	They do not include nor equity neither derivatives whose underlying assets could be consider equity.
<b>Mixed fixed income</b>	They are the ones in which less than 30% of the portfolio is invested in equity.
<b>Mixed variable income</b>	Between 30% and 75% of the portfolio is invested in equity.
<b>Variable income</b>	More than 75% of the portfolio is invested in equity.
<b>Guaranteed</b>	These kinds of plans have an external guarantee given by a third party that makes sure that a determined return will be obtained.

Table 7 Categories of pension plans according to their type of assets invested. Source: INVERCO.

In the category of fixed income, when the mean portfolio duration is lower or equal to two years, they will be short-term plans. Otherwise, they will be classified as long-term ones.

### **3. DIFFERENCES BETWEEN INDIVIDUAL AND OCCUPATIONAL PENSION PLANS**

Even though, some of the main differences, regarding their promoters and participants have been explained in the section, other ones considered by Fuentes (2016), will be mentioned. Some of them are essential for understanding the different results obtained, once the evaluation of the performance persistence is done.

- **Mobilization of consolidated rights**

Individual pension plans allow the mobilization of consolidated rights from one plan to another, whenever the participant would want to do it. Thus, they are more flexible. In contrast, the participants of the occupational plans could only modify them when the labour relationship is extinguished.

- **Investments**

Because of the fact that in occupational plans the consolidated rights cannot be moved, this fact guarantees higher stability to the pension plan. In consequence, there is higher accuracy in order to define the investments.

- **Investment policy**

All the assets invested in the occupational pension plans are focused on the same aim, despite there are different types of contributions depending on the individual. That is why they have the same investment policy and it could not satisfy the needs of all the participants of the plan, especially when the group is heterogeneous. In those cases, it

usually benefits the workers who are near the retirement because it gives more benefits to the ones investing higher amount of liquid assets.

On the other hand, individual pension plans should take advantage of the possibility of creating a pension plan which fits their needs. Consequently, they should select the best financial entity to get their target.

- **Information**

Although the common investment policy could be understood as a negative characteristic, it is good for being informed about the performance of the pension plan. Decisions are taken in a collective way and they usually have a long-term perspective because the employer-employee relationship should be longer.

In addition, the contributions are related to workers' salaries, which cause them to be totally certain. That is why financial flows can be easily predicted.

On the contrary, the investments in individual pension plans are mainly encouraged by fiscal incentive, so the main contributions take place in the last months of the year. In addition, their flexibility to move consolidated rights lead to higher uncertainty about their performance.

- **Control commission**

As for occupational pension plans, it is formed by some agents who represent the participant and beneficiary and the promoter. They should have the adequate knowledge in order to supervise the proper functioning of the pension plan so as to ensure that the objectives will be achieved. Thus, the regularity in the outcomes of pension plan is more likely to occur.

They should be looking forward to getting beneficiaries and participants' aim so they try to put in practice the techniques to achieve it. This does not mean that the situation will always be favourable (winners). However, if the performance is very bad, management firms could be changed, which should be avoided by these entities.

In contrast, in the individual case there is Control Commission only in the case of the existence of 2 or more promoters. As, in individual case promoters are financial entities, this situation is very unusual. Thus, from Ahumada (2010) point of view, he considers that pension fund's supervision is not objective because promoter and management and custody entities usually belong to the same financial group, so they manage the pension

plans just focusing on their incentives rather than on the beneficiaries' and participants' aim.

- **Management and custody commissions**

They are always smaller in occupational pension funds than in individual ones.

#### **4. PREVIOUS LITERATURE**

Researchers have developed different studies regarding collective investment assets in which can be included pension and mutual funds. This bachelor thesis is related to the evaluation of performance persistence in pension plans. For this purpose, it is interesting to present some of the earlier studies' results regarding this topic in two specific collective investment vehicles. Due to these vehicles are somewhat different, we will differentiate between pension and mutual funds' results.

Sharpe (1966), Treynor (1966) and Jensen (1968) were the pioneers in the analysis of persistence performance. They created the main performance measures that have been used by many scholars in order to make their own analysis and obtaining their conclusions. However, they are not perfect models because they were found some shortcomings, like in Jensen' alpha case. Nevertheless, they are the most used performance measures. The studies were made covering different portfolios and time periods and some of them suffered some kind of bias such as survivorship bias, especially found in the earlier studies. Thus, different conclusions have been derived.

##### **4.1. Mutual funds**

There is not a common conclusion regarding mutual funds' performance persistence.

On the one hand, Hendriks et al. (1993) and Brown and Goetzmann (1995), describe a short-run positive correlation between abnormal returns in subsequent years and relating persistence to the poor performance scenario. On the other hand, Grinblatt and Titman (1992) and Elton et al. (1996) defend long-term performance persistence due to the abilities that management companies have so as to use and administer all the available information.

Ciriaco and Santamaria (2005) show the existence of short-term and long-term performance persistence in Spanish mutual funds. It is mainly explained by losers' performance, but they could not determine the certain cause which develops this situation.

Bessler et al. (2010) conclude the lack of long-term performance persistence in US equity mutual funds which are actively managed. Apart from analysing the performance

persistence, they try to discover the reasons of this scenario. They analyze the effects of internal governance (change of fund manager) and external governance (outflows) and they conclude that both mechanisms and their interactions are the reasons for the lack of persistence in the long-term.

Taking into account management fees, Malkiel (1995) and Martí et al (2007) coincide in the existence of positive relationship between the management and operating expenses and the risk-adjusted return. This would mean that the better the management of the entity the higher the expenses the investor should pay. In contrast, Ippolito (1989) did not find any relationship between these two variables.

Ippolito's result coincides to the Carhartt's one (1997) whose sample show that "mutual funds that appear to follow the one-year momentum strategy earn significantly lower abnormal returns after expenses" (pp. 58). Thus, he concludes that "transaction costs consume the gains from following momentum strategy in stocks" (pp. 58).

Abinzano, Muga and Santamaria (2010) using stochastic dominance tests, to avoid the problems related to the choice of valuation model used to take into account differences in level of risk exposure, find performance persistence in style-adjusted returns, which is a cleaner, and less noisy measure of managerial skills differentials. Nevertheless, their results using non-style adjusted returns are very similar to those offered by Carhart (1997) because they find only short-term persistence and it can be attributed to differences in risk exposure between the loser and winner portfolios.

Muga and Santamaria (2010) show that managers adopt similar low penetration pricing marketing strategies, irrespective of managerial quality, thus risk-return relationships depends on the product's life cycle, which is an important result in order to analyse performance persistence in mutual funds.

Vidal (2016) find evidences in favour of the short-term performance persistence and market timing ability across deciles in the post-ranking quarter after developing the analysis in Spanish equity mutual funds from 1990-2015. In addition, it is explained that business cycle is more effective for top-performing funds and that the reaction to the macroeconomics predations is really useful for being a successful manager. Therefore, investors could use previous performance information to decide how and where they would invest.

## 4.2. Pension funds

There are many articles regarding the evaluation of performance persistence in UK and US pension plans, but this kind of studies are not common in Spain because pension plans appeared later. However, due to their boom, which occurred in Spanish market since 90s, it started to be considered an interesting topic to be studied. In the following paragraphs, some of the results of those studies will be summarized.

After the analysis of US pension funds, Coggin et al (1993) conclude that managers have special abilities to select the assets in which they invest the money, so they can achieve higher returns. Collins and Fabozzi (2000), which also evaluated variable income funds, arise to the same conclusion.

In the UK, Brown et al (1997) and Blake et al (1999) show lack of persistence in their results, but they did not consider survivorship bias, whereas it did was considered in Tonks's research (2005).

However, Thomas and Tonks (2001) show that in UK took place a similar scenario than the one previously mentioned in the US market, considering variable pension funds' returns. Then, Tonks (2005) carried out another analysis in which he studied the persistence in equity portfolios of UK pension funds from 1983-1997. He finds evidence of persistence in the short-term, but it is not found in long-term periods. In addition, he rejects the possibility of being caused by the momentum factor stated by Carhart (1997). He thinks that the lack of persistence in the long-run could be due to the movement of workers from one job to another.

Blake et al (2002) analysed 306 pension funds in UK market and the conclusion is that manager efficiency was low. In addition, Mittelstaedt and Olsen (2003) using multi-index model to study Chile's market, state that managers' strategies do not add value to the pension funds' returns.

Xiaohong and Mahieu (2008) find that active management is useful to obtain better results in the Dutch market, but pension plans do not show evidence to conclude the existence of performance persistence.

Concerning Spanish market, few studies have been carried out and some of their results will be explained showed in the following paragraphs. Ferruz, Vicente and Andreu (2007) confirm the existence of short-term performance persistence. In contrast, it cannot be said that there is middle-term performance (2-3 years).

Nevertheless, there are particular cases in which pension funds present persistence during longer periods. Regarding, manager influence, they conclude that “56% of pension managers investing in World equities are adding value with their active management” (p 27). Thus, the associated costs that managers receive are balanced out by the extra returns generated.

Martí and Matallin (2008) assert that the study of risk-adjusted returns considering annual and six-monthly periods, which can be a good reference for future returns, shows the existence of persistence. They also find that the impact managers have on the management of pension plans is negative because active management do not improve passive management returns. This means that the value added obtained by active management do not compensate costs charged, which is opposite to the findings of Ferruz, Vicente and Andreu (2007).

As fees are other key variables to determine net returns, it is very important to analyse their behaviour. In this way, Abinzano, Muga and Santamaria (2016a) find the importance of the investor type in the fee structures. In particular, they find evidence of market penetration strategies in individual pension plans (very similar to those find in mutual funds in Muga and Santamaria (2010) but none in occupational pension plans. They also find that the size of the fees depends on whether custodian and management firms belong or not to the same financial group.

Abinzano, Muga and Santamaria (2016b) find that fees are significantly higher in individual plans than in occupational plans, affecting the net performance. It suggests internal governance mechanisms are good mechanisms for the decision-makers to monitor and discipline the managers. Finally, Abinzano Muga and Santamaria (2016c) using a diff in diff analysis to avoid the endogeneity problems, conclude that the change of managerial firm significantly reduces management fees for employer-sponsored plans and increase fees for individual pension plans. This result can be due to the differences in internal governance mechanisms between both types of pension plans in Spain.

In summary, it cannot be stated a common conclusion about the existence of persistence neither in mutual funds nor in pension funds’ scenario due to the high number of factors that affect them.



## 5. OBJECTIVE

Pension and fund plans represent a substantial part of people savings. Their performance is one of the most important factors which should be considered in order to make the decision about which would be the best plan to invest in. This is explained by the fact that the higher the returns of the plan, the higher the payments received when the contingency occurs. Therefore, the main objective of this bachelor's thesis is to verify if performance persistence exists. The analysis will be made on individual and occupational Spanish mixed fixed and variable income pension plans. We will study it from a long-term and medium-term point of view, from 2008 to 2014.

The aim is to investigate if the return of plan  $i$  during period  $t$  exhibit a systematic relationship with the return of this plan in period  $t-1$ , in other words, if it is possible to predict future returns taking into account past ones. With this information, it could be said if there are good or bad managerial firms.

An important issue that should be considered is that Spanish market has different characteristics than UK or US market which causes that the analysis that is done can be interpreted in different ways. For example, as Martí and Matallín (2008) mentioned, in the case of UK or US investing in private pension plan is a tradition while in Spain is relatively a recent way of investment.

Firstly, the process will be done on individual pension plans. Raw returns of the two types of plans (MFI and MVI) will be selected, considering two periods: 2008-2011 and 2012-2014. Then, we will present a global conclusion and three-year analysis' one.

Secondly, we are going to develop the same study but considering the risk that is faced by each of them. Sharpe ratio will help us to develop the test taking into account this variable. The proxy variable for the risk-free asset will be the annual return of treasury bills. Thus, we would be able to evaluate the additional returns generated by each plan per unit of total risk assumed.

Thirdly, the same process will be followed but using the data of occupational pension plans.

Finally, the results obtained will be presented and we will arise to the corresponding conclusions. Additionally, the differences in internal governance mechanisms between occupational and individual pension plan could help us to explain the outcomes achieved.

## 6. DATABASE

Our first idea was getting the data from INVERCO which is an association of collective investment and pension funds. It groups the Spanish pension funds, as well as, other kind of information and it offers monthly and quarter information related to pension and fund plans since 2001.

However, in 2014 there was a change in the denomination of most of the pension funds and plans, maybe because some of them disappear or they were merged into others. In consequence, it could not be evaluated the performance persistence of the plans during the whole period. Since 2014 it was like doing an analysis of different pension and fund plans and this did not have sense with the purpose of the thesis.

Therefore, we decided to use the data from another source: General Directorate of Insurance and Pension Funds (Ministry of Economy). Despite we cannot analyse the most recent years' performance, because the available information just offers data from 2008 to 2014, we thought that it would be the most accurate one for our thesis. From all the available information, we chose the one of December for every year included in the study period.

We decided to analyse two types of pension plans: individual and occupational. Both belong to the Spanish system of pension plans. According to their duties, they are classified as determined contribution pension plans. With regard to the type of assets invested, we gather the one related to mixed fixed and variable income pension plans.

- Mixed fixed income pension plans (MFI) are the ones in which less than 30% of the portfolio is invested in equity.
- Mixed variable income plans (MVI) are the ones in which between 30% and 75% of the portfolio is invested in equity.

The persistence will be studied in 405 MFI and 272 MVI individual pension plans from 2008 to 2014. With regard to occupational ones, the analysis will be done over 865 MFI and 309 MVI pension plans. We will develop it using raw-returns and risk-adjusted return. For the last case, Sharpe-Ratio will be used.

All the plans that can be identified during the evaluation period are included in the test, in order to avoid the survivorship bias. It represents the tendency for pension plans with poor performance to be dropped by pension plans' companies, generally because of poor results

or low asset accumulation. This phenomenon, which is widespread in the pension plans industry, results in an overestimation of the past returns of mutual funds.

Despite all this information has a public access, we need to organize it in a useful way for developing the study. Using Microsoft Excel, we created our own database from the information published.

It includes the following information:

- Type of fund (occupational an individual)
- Investment objective (variable or fixed mixed income)
- Code of fund
- Code of plan
- Year
- Return
- Risk
- Risk-adjusted return (this variable was computed using risk and return information from the INVERCO web and the yearly-return of treasury bills, obtained from Bank of Spain web)

Once the data was organized, the first step was computing the median return for each of the years. After that, it was developed different tables in order to define if the plan could be considered a winner or a loser, depending on their return with respect to the median. (Winner if its return is higher than the median and loser if it is lower).

With all this information, the persistence could be evaluated taking into account the possible situations that take place from one period to the other. The four options could be: winner-winner (1); loser-loser (4); winner-loser (2) or loser-winner (3). The first two cases show a persistence situation and the last ones, a reversal one.

Finally, the most important variables that will be used in the thesis will be explained. Some have been previously mentioned, so we are not going to repeat them.

- RETURN

The main element which is needed for the study is the return. It is the gain or loss of a security in a particular period. It consists of the income of the capital gains relative on an investment and it is usually quoted as a percentage.  $R_t = \ln \frac{L_t}{L_{t-1}}$ , where  $R_t$  is the raw return of the period  $t$  and  $L_t$  is the Liquidation value of all of pension plan assets. The

general rule is that the more risk you take, the greater the potential for higher returns and losses.

- RISK

It is useful for the computation of the Sharpe-ratio to get risk-adjusted returns. It involves the chance an investment's actual return will differ from the expected return. Risk includes the possibility of losing some or all the original investment. Risk is usually proxied by the standard deviation of the pension plan returns ( $\sigma_t$ ).

- RISK-ADJUSTED RETURN

It is a variable which refines an investment's return by measuring how much risk is involved in producing that return, which is generally expressed as a number or rating. In this study, the ex-post Sharpe ratio is used to this purpose. The classical measure of the Sharpe ratio ( $S_t$ ) is:  $S_t = \frac{R_t - R_f}{\sigma_{R_t - R_f}}$  where  $R_t$  is the realized return of the period  $t$ ,  $R_f$  is the risk-free rate and  $\sigma_{R_t - R_f}$  is the standard deviation of the difference between plan' return and risk free rate<sup>2</sup>.

- MEDIAN

It is the middle number in a sorted list of numbers. To determine the median value in a sequence of numbers, the numbers must first be arranged in value order from lowest to highest. If there is an odd amount of numbers, the median value is the number that is in the middle, with the same amount of numbers below and above. If there is an even amount of numbers in the list, the middle pair must be determined, added together and divided by two to find the median value. The median can be used to determine an approximate average.

## 6. METHODOLOGY AND PERFORMANCE MEASURES

There are different methods to measure pension plans' performance. However, the most important ones are Jensen's alpha, Treynor's ratio and Sharpe's ratio. The latter considers both the returns and the risks of the funds without taking into account any market index. In contrast, Jensen's alpha and Treynor's ratio do pay attention to market index.

---

<sup>2</sup> We have only annual return for the pension plans. For this reason, we have used  $\sigma_t$  instead of  $\sigma_{R_t - R_f}$ . Both measures are equal if  $R_f$  is constant and the correlation between  $R_t$  and  $R_f$  is zero.

Apart from that, we have to mention that Jensen's alpha is an absolute measure, but the other two are relative ones.

### **6.1. Jensen's alpha**

According to Jensen's (1967), the portfolio's performance can be understood in two different ways. Firstly, it can be explained as the managers' ability to increase the returns of the pension plan thanks to their ability to predict the liquidity values. Secondly, it can be the ability to minimize the portfolio's risk by the appropriate assets' diversification of the assets of that portfolio. Nevertheless, Jensen's alpha just refers to the first explanation.

Within CAPM (Capital Asset Pricing Model), Jensen's alpha is computed by the estimation of the constant of the model. It shows the excess of returns that can be achieved by the manager considering the expected risk of the fund which is being managed.

It is an absolute performance indicator, which means that apart from giving information which allows creating a pension plans' ranking taking to consideration the alpha associated to each of them, it informs us about whether the pension plan is doing well or not.

Jensen's equation:

$$\alpha_j = (R_k - R_f) - \beta_k (R_m - R_f)$$

where  $R_k$  is the return of fund  $k$ ,  $R_f$  is the return of the risk-free asset,  $R_m$  is the market portfolio return and  $\beta_k$  is the beta of the fund  $k$ .

An assumption for that model is that all the assets which faces the same risk, they should have the same returns. Thus, when alpha is bigger than 0, it is said that the fund gets better returns than the expected by the model. Consequently, it can be concluded that the manager ability to choose the assets influences the returns achieved.

### **6.2. Treynor's ratio**

Another performance measure is the one introduced by Treynor (1965). It is a relative one because it measures the excess return achieved by the pension plan with respect to the risk-free assets per unit of systematic risk assumed.

Treynor assumes that all the assets are valued properly and the only task of the manager is to diversify the portfolio appropriately taking into account the level of risk that it has to face. In consequence, it does not evaluate the excess return that the manager could achieve due to their prediction abilities.

$$\text{Treynor's ratio} = \frac{E(r_k - r_f)}{\beta_k}$$

Where  $E(A)$  means the expected value of  $A$ ;  $r_k$  is the return of the pension plan  $k$ ;  $r_f$  is the return of the risk-free asset and  $\beta_k$  is the beta of the pension plan  $k$ .

### 6.3. Sharpe's ratio

This ratio was introduced by William F. Sharpe in 1966. At the beginning, it was called reward to variability ratio. It relates the mean and standard deviation of the pension plan's performance to the risk-free assets. Therefore, it states the additional return obtained per unit of total risk which is assumed. Consequently, the hypothesis assumed by Treynor is not considered, so the fact that pension plan's performance is not as good as the market could be justified by the existence of non-systematic risk or that it cannot be diversified over the portfolio.

It is the only universal measure of the three explained. This means that it considers the total risk of the portfolio (specific and systematic ones).

The ex-ante formula is:

$$\text{Sharpe's ratio} = \frac{E(R_k - r_f)}{\sigma(R_k - r_f)}$$

Where  $E(A)$  means the expected value of  $A$ ;  $R_k$  is the return of the pension plan  $k$ ;  $r_f$  is the return of the risk-free asset and  $\sigma$  represents the standard deviation of the pension plan's performance. As was mentioned before if we use realized  $R_k - r_f$  instead of its expected value we have the ex-post formula that will be used in this thesis.

The bigger the ratio, the better the performance related to the risk assumed. Furthermore, if the ratio is lower than zero, the performance of the pension plan will be lower than the risk-free asset one and if it is lower than one, the performance will be lower than the risk assumed. It used to be greater than one.

In order to compute the first two measures, it is needed the information of  $\beta_k$  which represents the systematic risk of a pension plan with respect to the whole market. Nevertheless, as we gather yearly information of 7 years, it is not enough to obtain a good estimation of beta.

As a result, we decided to use the Sharpe's ratio. As was mentioned before, regarding the proxy variable for the risk-free asset, we selected the information from treasury bills'.

## 7. METHODOLOGY AND PERSISTENCE MEASURES

In this section, two of the most important methods to measure pension plans' performance persistence will be explained: Carpenter and Lynch chi-squared test and CPR. They are non-parametric statistics which provide us additional information related to the possible source of the persistence.

Both statistics classify the pension plans' performance into two groups: winners and losers. One pension plan will be considered winner if its return is higher than the median computed for the group of pension plans to which it belongs. Thus, we will consider that persistence exists if during two consecutive periods, that pension plan performs better than the median (winner) or worse than it (loser). For the first case the denomination would be WW and for the second one LL.

On the other hand, it could take place that one pension plan would has been considered winner in the previous period, but during this one its return is lower than the median or vice versa. With regard to the denomination, it would be WL or LW respectively.

With this classification, we are able to compute the following persistence measures.

### 7.1. Chi-squared test by Carpenter and Lynch

Carpenter and Lynch (1999) proposed a chi-squared test using absolute frequencies' samples they had obtained after developing the pension plans' analysis (WW, LL, WL and LW). The null hypothesis of this test is the independence. Thus, we can reject it but this does not mean that we can assume persistence.

They found that  $\chi^2$  is one of the most effective tests for detecting the existence of persistence. Moreover, it is the most robust one when the database has a survivorship bias. Its formula is the following:

$$\chi_1^2 = \frac{[(WW - \frac{N}{4})^2 + (LL - \frac{N}{4})^2 + (WL - \frac{N}{4})^2 + (LW - \frac{N}{4})^2]}{\frac{N}{4}}$$

Once it is computed Chi-squared and its corresponding p-value, we are able to know if we could reject the null hypothesis. If it does occur, it is needed to identify if we are under a reversal or persistence case.

## 7.2. CPR (Cross-Product Ratio)

When we have defined the category to which its pension plan belongs, the CPR could be computed using this formula:

$$CPR = \frac{(WW \times LL)}{(WL \times LW)}$$

If  $CPR > 1$ , there are favourable results to the existence of persistence and if  $CPR < 1$ , we will talk about reversion.

However, after concluding if there is persistence or reversion, it is needed to know if the analysis is significant, which means that we can reject the null hypothesis: lack of persistence. So as to know it, we will compute Z statistic, which follows a normal distribution, using this formula:

$$Z = \frac{\ln(CPR)}{\sigma_{\log(CPR)}}$$

$$\text{being } \sigma_{\log(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}}$$

If we obtained favourable results ( $CPR > 1$ ), it will be interesting to compute  $Z_x$  ( $x = W$  (winners and  $L$ =losers) which will give us information about the source of persistence. It could be caused by winners, losers or both pension plans. Since  $n \geq 20$ , it follows a normal distribution:

$$Z_x = \frac{Y_x - n_x p}{\sqrt{n_x p(1-p)}}$$

where  $Y_x$  are the number of W in the case of  $Z_w$  (or L in  $Z_l$ ) in the present period that they were also W (L) in the precedent period;  $n_x$  is the total number of W or L in the precedent period and  $p$  is the probability of getting persistence, in this case, 0.5.

If the results are not favourable, CPR is lower than 1 and Z will be negative.

## 8. ANALYSIS AND RESULTS

### 8.1. Individual pension plans

#### 8.1.1. Raw returns performance persistence study in individual pension plans

First of all, we are going to study performance persistence using the raw returns from MFI and MVI pension plans. It will be a long-term analysis because we take the annual returns of the pension plans during the following period: 2008-2014. As two types of pension plans will be studied, we had to organize the values in two different tables.



One of the problems that we have to face was the disappearance, appearance and merge of some of the pension plans. This fact caused that we did not have data for some of them in any given year. In order to avoid the survivorship bias, we consider all the pension plans that have existed during the study period (2008-2014). It is really important to prevent this error in a performance persistence study.

When we have the data for each category of pension plan, we started the computations in order to develop the study using two different statistics: Chi-Squared analysis and cross-product-ratio (CPR), as it was mentioned in previous sections.

Data was analysed in two different ways. On the one hand, the study period was divided in two parts: 2008-2011 and 2012-2014. Then, we added the returns of each of the years included in each term and it was computed just one return for each of them. Finally, it was done a performance persistence study considering just these two periods of time. On the other hand, using the computations from one year-one year analysis, we performed a global one so as to get an aggregate conclusion.

Pension plans should be defined as winners or losers, depending on the return of the pension plan with respect to the median of the period considered.

The next step was evaluating the performance persistence, which means determining which of the following situations takes place: WW, WL, LW, and LL. Using this data, we can compute CPR and Chi-squared statistics.

Firstly, Chi-squared result will be explained and they will be followed by CPR ones. In both tests, the null hypothesis shows a lack of persistence scenario. In the case of Chi-squared test, it states that there is not performance persistence because they are time-independent. In contrast, CPR tests the proportion of pension plans that exhibit persistence with respect to those which not. (CPR is equal to 1 and each of the four categories are thought to have 25% of the pension plans).

Other fact to consider is that the null hypothesis just tells information about the existence or lack of persistence. That is why, if the statistics conclude that there is persistence, we have to compute  $Z_x$ -test in CPR analysis, in order to know the origin of this persistence. As  $n \geq 20$ , it follows a normal distribution and the “x” could be L (losers) or W (winners). In order to test our hypothesis, we would consider a 95% confidence interval so we would reject the null hypothesis if p-value is lower than alpha (5%). In this case, we can state that

the conclusions are significant. All these computations assume that the data follows a normal distribution.

Chi-squared test is more powerful and robust to the existence of survivorship bias than the CPR test. Nevertheless, CPR is an interesting test because, if persistence exists, CPR will be used to determine its origin.

Before going into detail in the performance persistence study, the median values for each of the period and pension plan category will be presented. (Tables 8 and 9). This is the factor which determines if a pension plan is winner or loser and the rest of the analysis is developed considering this assumption.

MFI INDIVIDUAL									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-7.440%	6.240%	-1.225%	-1.265%	4.680%	6.530%	4.110%	-1.800%	14.660%

Table 8 Median values of the raw-returns obtained by mixed fixed income individual pension plans from 2008-2014 (%).

MVI INDIVIDUAL									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-18.89%	12.95%	-1.87%	-6.315%	7.690%	11.695%	3.670%	-18.89%	12.95%

Table 9 Median values of the raw-returns obtained by mixed variable income individual pension plans from 2008-2014 (%).

## ❖ CHI-SQUARED Test

### MFI (Mixed Fixed Income)

Global and medium-run analyses conclude that we can reject the independence between the variables because both p-values (0.04 and 0.03, respectively) are lower than alpha. They were derived from the computation of both Chi-squared statistics (4.2947 and 4.5422).

The type of relationship between the variables, which could be reversal or persistence, will be determined after the computation of the CPR test, if it also allows a rejection of null hypothesis. Otherwise, a general conclusion cannot be obtained. This process will be identical in each of the analysis.

The results are summarized in table 10.

MFI INDIVIDUAL		
Period	Chi	p-value
Medium-run	4.5422	0.0331
Global	4.2947	0.0382

Table 10 Results from the Chi-squared test in MFI individual pension plans (raw-returns).

### **MVI (Mixed Variable Income)**

The results of the statistic regarding medium-run, are also clear,  $\text{Chi} = 6.7912$  and p-value (0.01), so we can reject the null hypothesis.

However, the results at a global level,  $\text{Chi}=0.7058$  and p-value (0.40), do not permit us to reject the null hypothesis of absence of persistence performance.

In table 11 we show the results of mixed variable income pension plans analysis.

MVI INDIVIDUAL		
Period	Chi	p-value
Medium-run	6.7912	0.0092
Global	0.7058	0.4008

Table 11 Results from the Chi-squared test in MVI individual pension plans (raw-returns).

### **❖ CPR Test**

#### **MFI**

We are testing the null hypothesis of lack of persistence. In the case of the medium-term analysis, we obtain a CPR value equal to 0.6188 with the Z-statistic equal to -1.8740 ( $p=0.03$ ). Thus, we conclude the existence of reversion, which means that pension plans which were winners in period  $t-1$  will be probably losers in the following one and vice versa.

In contrast, the data from the global test shows a  $\text{CPR} = 1.2075$ .  $\text{CPR} > 1$ , so if p-value would be lower than alpha, we would conclude persistence, because null hypothesis would be rejected. However, it is not the case ( $p=0.16$ ) so variables are supposed to be independent.

In table 12, it can be observed the results obtained from the analysis.

MFI INDIVIDUAL					
Period	CPR	ln(CPR)	$\sigma\log(\text{CPR})$	Z	p-value
Medium-run	0.6188	-0.4799	0.2561	-1.8740	0.0305
Global	1.2075	0.1885	0.1885	1.0002	0.1586

Table 12 Results from the CPR test in MFI individual pension plans (raw-returns).

In summary, in the medium-run takes place a reversal scenario because both statistics reject the null hypothesis and then, the relationship between variables is defined by CPR. In contrast, in global terms, it cannot be obtained a general conclusion because CPR results do not allow the rejection of the null hypothesis, while p-value in the Chi-squared test is lower than alpha.

### MVI

The results of the mixed variable income pension plans, presented in table 13, offer conclusions very similar to those obtained using MFI ones.

Regarding the medium-run analysis,  $\text{CPR} = 0.4853 < 1$ , so it also means reversal. Computing the Z-statistic ( $Z=-2.3892$ ) and then, the p-value ( $p=0.01$ ), we can reject the null hypothesis so the conclusion is significant.

In the global study,  $\text{CPR} = 1.06 > 1$  implying the existence of persistence. Nevertheless, lack of persistence assumption cannot be rejected, which is supported by Z-statistic ( $Z=0.4967$ ) and its p-value (0.31), which is higher than alpha.

MVI INDIVIDUAL					
Period	CPR	ln(CPR)	$\sigma\log(\text{CPR})$	Z	p-value
Medium-run	0.4853	-0.7230	0.3026	-2.3892	0.0084
Global	1.0604	0.0586	0.1180	0.4967	0.3097

Table 13 Results obtained after performing CPR analysis in MFI individual pension plans (raw-returns).

To sum up, the final outcomes obtained in the medium-run is a reversal scenario, while globally, in both cases, we cannot reject the null hypothesis.

### 8.1.2. Risk-adjusted performance persistence study of individual pension plans

Risk is an important factor in the study of performance persistence. However, in the previous section we have not considered it. That is why, we repeat the analysis using the Sharpe's Ratio. In this part, the conclusions obtained will be presented and we can verify if they are the same as in the previous section. Otherwise, we could see the importance of risk in this kind of studies.

As was mentioned before, Sharpe's ratio will be the performance measure used which would allow us to develop the risk-adjusted analysis.

For its computation, we need the return and risk of the pension plans and the risk-free asset return. The proxy selected for the risk-free assets' return has been the average yearly return of treasury bills' market. This information was taken from Bank of Spain database.

After that, we computed the risk-adjusted returns for each pension plan and it was followed the same process to study performance persistence than in the raw-return case. The results will be presented in the same way, firstly the ones from Chi-squared and then CPR ones.

Nevertheless, firstly the median values will be displayed because, as we have explained before, they are crucial for evaluating the performance persistence. (Tables 14 and 15).

MFI Individual plans (Sharpe-ratio)									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-1.452%	0.965%	-0.944%	-0.943%	0.558%	1.289%	1.078%	-2.233%	2.384%

Table 14 Median values of the risk-adjusted returns of MFI individual pension plans from 2008-2014. (%).

MVI individual plans (Sharpe-ratio)									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-1.537%	0.901%	-0.400%	-0.830%	0.612%	1.257%	0.408%	-1.553%	2.111%

Table 15 Median values of the risk-adjusted returns of MVI individual pension plans from 2008-2014. (%).

## ❖ CHI-SQUARED Test

### MFI

Not only in the medium-run evaluation, but also in global terms, lead to the same conclusion (Chi=25.1661 and Chi=99.0502, respectively, with p-value equal to 0.00 in both cases). Therefore, it is concluded that there is some dependence between the variables.

The results are shown in table 16.

MFI INDIVIDUAL (Sharpe-ratio)		
Period	Chi	p-value
Medium-run	25.1661	5.26E-07
Global	99.0502	2.4618E-23

Table 16 Results of the Chi-squared test in MFI individual pension plans using risk-adjusted returns.

### **MVI**

The medium-run analysis test offers a Chi=2.1667 and its p-value (0.14) is higher than alpha, so we cannot reject the null hypothesis. In consequence, we assume that there is lack of persistence.

In contrast, from a global perspective, the Chi-squared statistic is equal to 145.6197 which lead to a p-value (0.00). Consequently, independence scenario is rejected.

The results are shown in table 17.

MVI INDIVIDUAL (Sharpe-ratio)		
Period	Chi	p-value
Medium-run	2.1667	0.1410
Global	145.6197	1.5721E-33

Table 17 Results of the Chi-squared test in MVI individual pension plans using risk-adjusted returns.

### **❖ CPR Test**

### **MFI**

The results regarding CPR-statistic of mixed-variable income pension are collected in table 18.

In both cases, CPR is higher than one (CPR=3.33 and CPR=2.771), which means performance persistence. In addition, after computing both Z-statistic tests (4.7776 and

9.7390) and their corresponding p-values, they are clearly lower than alpha (0.00 and 0.00). Therefore, performance persistence is significant.

The next step is defining the origin of the persistence, so it will be computed the test for each of the possible sources: winners and losers.

Once these computations have been done, not only in the medium-run, but also in global terms, we can only reject the null hypothesis regarding winners' performance, whose p-value is lower than 0.05. In consequence, pension plans which over-perform in period t-1 will do the same in period t.

In conclusion, not only in the medium-run, but also in the global evaluation, both statistics arise to the same result: the existence of persistence. Then, due to CPR analysis, it can be concluded that it is due to winners.

MFI INDIVIDUAL (Sharpe-ratio)									
Period	CPR	ln(CPR)	$\sigma\log(\text{CPR})$	Z	p-value	Zw	p-value	Zl	p-value
Medium-run	3.3311	1.2033	0.2519	4.7776	0.00	3.4292	0.00	1.3064	0.096
Global	2.7771	1.0214	0.1049	9.7390	0.00	2.5496	0.0054	1.6284	0.052

Table 18 Results obtained after performing CPR analysis in MFI individual pension plans using risk-adjusted returns.

## MVI

Medium-run and global analyses offer the following results. CPR=1.4063 and CPR=1.0736. However, their corresponding Z statistics are equal to 1.17 and 0.55 whose p-values are higher than alpha (0.1202 and 0.2913, respectively). Consequently, variables are independent.

Table 19 collects all of these results.

MVI INDIVIDUAL (Sharpe-ratio)					
Period	CPR	ln(CPR)	$\sigma\log(\text{CPR})$	Z	p-value
Medium-run	1.4063	0.3409	0.2904	1.1739	0.1202
Global	1.0736	0.0710	0.1292	0.5495	0.2913

Table 19 Results obtained after performing CPR analysis in MVI individual pension plans using risk-adjusted returns.

After analyzing both statistics' results, the main difference occurs in the global study because CPR results state lack of persistence, while under Chi-squared statistic's study, it the null hypothesis can be rejected. On the contrary, in the medium-run both results define a lack of persistence scenario.

We can see differences between raw-returns and risk-adjusted returns results, so it is verified that risk does affect performance persistence results.

## 8.2. Occupational pension plans

The data for occupational pension plans is also taken from General Directorate of Insurance and Pension Funds (Ministry of Economy). As in the individual case, we are going to study two types of occupational pension plans: MFI and MVI. The process and the way of organizing the results is the same too.

### 8.2.1. Raw returns performance persistence study in occupational pension plans

First of all, we have to organize the data to be useful for the study. In that case, we just need the returns of both categories of pension plans (MFI and MVI). With them, we can compute the median for each of the years, which is the crucial factor for analysing the persistence. (Table 20 and 21).

MFI Occupational plans									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-5.470%	5.680%	0%	-0.320%	5.880%	7.470%	6.115%	0.365%	18.475%

Table 20 Median values of the raw-returns of MFI occupational pension plans from 2008-2014. (%).

MVI Occupational plans									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-16.87%	11.31%	0.67%	-2.39%	8.57%	8.78%	6.20%	-7.77%	22.47%

Table 21 Median values of the raw-returns of MVI occupational pension plans from 2008-2014. (%).

After that, we could define if the pension plan is a winner or a loser and we would be able to compute each of the statistics. The process has been previously explained, so we just would like to remind, that the level of significance is equal to 5%.



## ❖ CHI-SQUARED Test

### MFI

In both analyses (medium-run and global), the lack of persistence scenario can be rejected because after computing both Chi-squared tests (Chi=42.09 and Chi=22.79) and performing their hypothesis tests, p-values are lower than alpha (0.00 and 0.00).

The results are shown in table 22.

MFI OCCUPATIONAL		
Period	Chi	p-value
Medium-run	42.0933	8.70193E-11
Global	22.7858	1.81096E-06

Table 22 Results of the Chi-squared test developed in MFI occupational pension plans (raw-returns).

### MVI

As in the previous analysis, we can conclude that there is some dependence between variables, which would be defined with the CPR test. CPR results should allow the rejection of the hypothesis too.

This is reinforced by the results obtained after computing chi-squared statistic, which are shown in table 23. In the medium-run (Chi=21.9192 and p-value=0.00), and in the global study (Chi=28.4149 and p-value=0.00).

MVI OCCUPATIONAL		
Period	Chi	p-value
Medium-run	21.9192	2.8438E-06
Global	28.4149	9.7911E-08

Table 23 Results of the Chi-squared test developed in MVI occupational pension plans (raw-returns).

## ❖ CPR Test

### MFI

About the medium-run analysis, lack of persistence scenario is rejected ( $Z=5.7236$  offers a small p-value (0.00)). Focusing on CPR statistic, it is equal to 2.6286. As it is higher than 1, performance persistence is concluded.

Then, we are interested in knowing its origin, because it could be due to winners or losers. Therefore, the corresponding Z-statistics are computed;  $Z_w$ , if we are testing winner's persistence and  $Z_l$ , in the losers' case. We can reject both null hypothesis because their p-values are clearly lower than alpha (0.00). However, the only Z-statistic which shows evidences of persistence, is the winners' one. In order to conclude persistence  $Z_x$  has to be positive. Consequently, we conclude that persistence is due to winners' performance.

In the global test, we find evidences to conclude that persistence is significant because CPR (1.3661) is higher than 1 and its Z-statistic is 4.7457 brings a small p-value (0.00), which is lower than alpha. Thus, lack of persistence assumption can be rejected. However, when we perform  $Z_w$  and  $Z_l$ , the p-values obtained (0.37 and 0.45) are higher than alpha. Thus, it cannot be found the origin of the persistence.

The results are shown in table 24.

MFI OCCUPATIONAL									
Period	CPR	ln(CPR)	$\sigma\log(\text{CPR})$	Z	p-value	$Z_w$	p-value	$Z_l$	p-value
Medium-run	2.6286	0.9665	0.1689	5.7236	0.00	2.0003	0.0023	-2.7224	0.0032
Global	1.3661	0.3119	0.0657	4.7457	0.00	0.3239	0.3730	-0.1362	0.4458

Table 24 Results of the CPR analysis performed in MFI occupational pension plans (raw-returns).

To sum up, in the medium-run both statistics reject the null hypothesis and CPR results state that persistence's origin can be either due to winners or losers. In the global case, although both statistics reject the null hypothesis, the source of persistence cannot be defined.

## **MVI**

In the following analysis, the conclusions will be commented in a different way. In order to develop them, the results displayed in table 25 have been used.

Considering medium-run and global Z-statistics, (3.9397 and -5.2707) and their p-values (0.00 and 0.00), we can conclude that there is some dependence between the variables. Moreover, just paying attention to these two values, the type of relationship can be determined.

In the three-year testing analysis Z is positive, which means persistence. The one related to the global test is negative, an indicator of reversal. What is more, we have already proved that these results are significant. This will be ratified with CPR values.

In the medium-run, we got  $CPR=3.2475$  which is higher than 1 (persistence). In contrast, in global terms, CPR is equal to 0.5523(reversal).

MVI OCCUPATIONAL									
Period	CPR	ln(CPR)	σlog(CPR)	Z	p-value	Zw	p-value	Zl	p-value
Medium-run	3.2475	1.1779	0.2990	3.9397	0.00	1.6600	0.0484	-2.2630	0.0118
Global	0.5526	-0.5931	0.1125	-5.2707	0.00	-1.8143	0.0348	-2.4825	0.0065

Table 25 Results of the CPR analysis performed in MVI occupational pension plans (raw-returns).

With respect to the medium-term results, the outcomes from the null hypothesis match with the Chi-squared ones, so the final conclusion would be the existence of persistence due to winners and losers. In contrast, globally it is found a reversal scenario.

### 8.2.2. Risk-adjusted performance persistence study of individual pension plans

First of all, we would like to remind that the performance measure used so as to consider the impact of the risk is the Sharpe's ratio.

As in previous cases, median values will be presented because they are the ones who will allow us to define a pension plan as a winner or as a loser. After that, Chi-squared and CPR could be computed and the results will be exhibited in the following sections. (Table 26 and 27).

MFI Occupational plans (Sharpe-ratio)									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-1.286%	1.069%	-0.681%	-0.757%	0.858%	1.558%	1.474%	-1.780%	3.487%

Table 26 Median values of risk-adjusted returns obtained from MFI occupational pension plans from 2008-2014. (%)

MVI Occupational plans (Sharpe-ratio)									
Year	2008	2009	2010	2011	2012	2013	2014	2008-2011	2012-2014
Median	-1.623%	0.807%	-0.222%	-0.597%	0.856%	1.395%	1.098%	-1.554%	2.994%

Table 27 Median values of from the risk-adjusted returns got from MVI occupational pension plans from 2008-2014. (%).

We would like to highlight than the null hypothesis not only to the CPR but also to the Chi-squared is the lack of persistence.

### ❖ CHI-SQUARED Test

#### MFI

In both tests, medium-run and global, (Chi=30.1728 and Chi=123.7513, respectively), we can reject the assumption of independence between the variables because both p-values (0.00) are lower than alpha.

The information is showed on table 28.

MFI OCCUPATIONAL (Sharpe-ratio)		
Period	Chi	p-value
Medium-run	30.1728	3.9522E-08
Global	123.7513	9.5494E-29

Table 28 Results of Chi-squared test performed in MFI occupational pension plans considering risk-adjusted returns.

#### MVI

As it is exhibited in table 29, the final conclusion is identical to the previous one. In both analyses, we can reject the null hypothesis (Chi=11.3116 and Chi=122.7019, respectively) because both p-values (0.00) are lower than alpha.

MVI OCCUPATIONAL (Sharpe-ratio)		
Period	Chi	p-value
Medium-run	11.3116	0.0007703
Global	122.7019	1.6206E-28

Table 29 Results of Chi-squared test performed in MVI occupational pension plans considering risk-adjusted returns

## ❖ CPR Test

### MFI

In table 30 are shown MFI results of CPR statistic. In the medium-run analysis,  $CPR=2.4548$  which is higher than 1, an indicator of persistence. We compute  $Z=5.3637$  and p-value (0.00) is lower than alpha, so performance persistence is significant.

After computing  $Z_w$  and  $Z_l$ , p-values (0.13 and 0.08), are obtained, which are higher than alpha. Consequently, there is a persistence scenario but it cannot be defined its origin.

Considering the global one, CPR is equal to 2.1248, a value which shows persistence ( $2.1248>1$ ). Computing its Z-statistic = 11.0361, it allows us to reject the null hypothesis (p-value, 0.00, is clearly lower than alpha) and the persistence is significant.

When, we compute  $Z_w$  and  $Z_l$  to identify the source of persistence, both p-values (0.00 and 0.02) are lower than alpha, so the origin of the persistence is due to winners and losers' performance.

FI OCCUPATIONAL (Sharpe-ratio)									
Period	CPR	ln(CPR)	σlog(CPR)	Z	p-value	Z <sub>w</sub>	p-value	Z <sub>l</sub>	p-value
Medium-run	2.4548	0.8980	0.1674	5.3637	0.00	1.1339	0.1284	1.4018	0.080
Global	2.1248	0.3119	0.0657	11.0361	0.00	2.6467	0.0041	1.9876	0.0234

Table 30 CPR results of the analysis performed in MFI occupational pension plans using risk-adjusted returns.

Both statistics lead to a rejection of an independence scenario. Therefore, CPR results are very robust because of their coincidence with Chi-squared tests. In summary, in the medium-run the origin of performance persistence is not determined, but in the global analysis, it can be concluded that it is due to winners and losers.

### MVI

In both cases (three-year-study and global one), we can conclude the existence of persistence. However, global results show that performance persistence is due to winners and losers, but in the medium-run, it cannot be defined the source of persistence. The reasons will be explained in the following paragraph and they are exhibited in table 31.

In the three-year-study,  $CPR=2.5204$  (higher than 1). As its Z-statistic=3.1650 lead to a p-value (0.00) lower than alpha, persistence is significant. Nevertheless, when we compute  $Z_w$

and  $Z_l$ , they bring p-values(0.42 and 0.096, respectively), which are higher than alpha. In consequence, there is a performance persistence scenario, but we cannot determine the origin.

In global terms, the type of dependence between the variables is the same ( $CPR=3.7175>1$ ). It is significant because Z-statistic is equal to 10.8788 which originates a p-value (0.00) clearly lower than alpha.

After computing  $Z_w$  and  $Z_l$ , we can also reject their null hypothesis. In consequence, the persistence is because of winners' and losers' outcome.

<b>MVI OCCUPATIONAL (Sharpe-ratio)</b>									
<b>Period</b>	CPR	ln(CPR)	$\sigma \log(CPR)$	Z	p-value	$Z_w$	p-value	$Z_l$	p-value
<b>Medium-run</b>	2.5204	0.9244	0.2921	3.1650	0.0008	-0.1857	0.4263	1.2999	0.096
<b>Global</b>	3.7175	1.3131	0.1207	10.8788	0.0000	2.6686	0.0038	2.7242	0.0032

Table 31 CPR results of the analysis performed in MVI occupational pension plans using risk-adjusted returns.

The final results are identical to the MFI analysis.

In comparison with the raw-returns, they are more similar than in the individual case, but they are some differences too. Therefore, it is also demonstrated that the risk can vary the final outcome.

## 9. LIMITATIONS

In order to develop this thesis, we have to face several limitations. The most important one is related to the database. We started to develop the study with information from INVERCO. However, in 2014, it was carried out a reform related to pension plans. In consequence, most of the plans' and funds' name changed and some of them disappeared too. Thus, it was impossible to put in practice a long-term analysis because neither there was data before 2014 related to the new plans, nor there was it since 2014 regarding the ones which had been eliminated.

With regard to the previous limitation, we can define another problem: the truncation of the data set, which happened due to the bad performance of losers' pension plans. Thus, it is likely that they disappear. This fact will have negative effects on our persistence study

which could cause that our results won't be totally correct. We are just evaluating surviving pension plans, so the average performance could be overestimated.

Furthermore, we have to cope with the lack of information problem. The database that we are using has public access. However, there could be better sources to find information but they are private, so we cannot have access to it. That's why the results obtained could not be as good as we would like to.

Apart from that, Spanish pension plans appeared in 1988, so its volume is limited and it was in the 90s when the demand grew. As a result, we could say they are not enough developed to state good conclusions about its performance.

## **10. CONCLUSIONS**

This bachelor's thesis studies the existence of performance persistence in Spanish individual and occupational pension plans from 2008 to 2014. The analysis was done using the data from mixed fixed and variable income pension plans.

Regarding individual pension plans, in most of the cases it cannot be concluded the existence of performance persistence. It only occurs in the MFI risk-adjusted returns' analysis. In contrast, most of the results obtained after evaluating performance persistence in occupational pension plans show evidences to conclude that it exists. Furthermore, we discovered that it is easier to occur when the test is done using risk-adjusted returns.

Even though there are more cases of performance persistence in occupational pension plans' results, it cannot be concluded, with significance, that the relationship between the variables is higher in occupational plans than in individual ones.

As Abinzano et al. (2016 b and c) have shown in relation to managerial fees or manage firm changes, it is reasonable to assume that these differences in performance persistence can be due to differences in corporate governance between both types of pension plans.

In the individual pension plans case, the most common situation is the existence of a unique promoter and there is no control commission (only an advocate of participants and beneficiaries). In addition, promoter's earnings are only related to the amount of money invested in the pension plan. Therefore, the manager will pay scarce attention to the returns obtained in the pension plan and that is why the irregular outcomes.

In the occupational pension plans, the control commission is formed by an agent who represents the promoter and a group of people who defend the interests of the participants

and beneficiaries. Each of the parts has the same proportion of control: 50%. In consequence, if the control commission considers that the returns obtained are not good enough, they can fire the management firm. This is an important bargaining power for the commission control that creates an important incentive for management firm to behave in interest of their participants.

## 11. REFERENCES

- Abinzano, I., Muga, L. and Santamaría, R. (2010). Do managerial skills vary across fund managers? Results using European mutual funds. *Journal of Financial Services Research*, 38(1), 41-67.
- Abinzano, I., Muga, L. and Santamaría, R. (2016a). The role of investor type in the fee structures of pension plans. *Journal of Financial Services Research*, 50, 387- 417.
- Abinzano, I., Muga, L. and Santamaría, R. (2016b). Bad Company. The indirect effect of bargaining power in the pension plan industry (September 14, 2016). Available at SSRN: <https://ssrn.com/abstract=2838891> or <http://dx.doi.org/10.2139/ssrn.2838891>.
- Abinzano, I., Muga, L. and Santamaría, R. (2016c). Governance, decision-maker and fee setting in the pension plan industry (August 22, 2016). Available at SSRN: <https://ssrn.com/abstract=2827519> or <http://dx.doi.org/10.2139/ssrn.2827519>.
- Ahumada, R.M. (2010). Los planes de pensiones de empleo e individuales. *Harvard Deusto Finanzas y Contabilidad*, 51, 62-69.
- Antón, J.I., Muñoz de Bustillo, R. and Fernández-Macías, E. (2014). Supplementary private pensions and saving: Evidence from Spain. *Cambridge University Press*, 13 (4), 367–388.
- Bessler, W., Blake, D., Lückoff, P. and Tonks, I. (2010). Why does mutual fund performance not persist? The impact and interaction of fund flows and manager changes. Available at SSRN: <https://ssrn.com/abstract=1695890> or <http://dx.doi.org/10.2139/ssrn.1695890>.
- Blake, D., Lehmann, B.N. and Timmerman, A. (1999). Asset allocation dynamics and pension fund performance. *Journal of Business*, 72, 429-461.
- Blake, D., Lehmann, B.N. and Timmerman, A. (2002). Performance clustering and incentives in the UK pension fund industry. *Journal of Asset Management*, 3, 173-194.
- BOE (2004). Funds and pension plans' law, *Royal decree 304/2004, 20 de Febrero, 2004*.
- BOE (2007). Personal Income Tax Law and reform of royal decree 304/2004, *Royal decree 439/2007 de 30 de Marzo de 2007*.



- Brown, S.J. and Goetzmann, W. (1995). Performance persistence. *Journal of Finance*, 50(2), 679-698.
- Brown, S.J. Draper, G.P. and McKenzie, E. (1997). Consistency of UK pension fund performance. *Journal of Business Finance and Accounting*, 24.
- Carhart, M. (1997). On persistence in mutual fund performance. *Journal of Finance*, 52, 57-82.
- Carpenter and Lynch (1999). Survivorship bias and attrition effects in measures of performance persistence. *Journal of Financial Economics*, 54, 337-374.
- Ciriaco, A. and Santamaría, R. (2005). Persistencia de resultados en los fondos de inversión españoles. *Investigaciones Económicas*, 29(3), 525-573
- Coggin, T.D., Fabozzi, F.J. and Rahman, S. (1993). The investment performance of U.S. equity pension fund managers: an empirical investigation. *The Journal of Finance*, 3, 1039-1055.
- Collins, B. and Fabozzi, F. (2000). Equity manager selection and performance. *Review of Quantitative Finance and Accounting*, 15, 81-97.
- Elton, E.J., Gruber, M.J. and Blake, C.R. (1996): The persistence of risk-adjusted mutual fund performance. *The Journal of Business*, 69(2), 133-157.
- Fernández, M.A., Martí, C.P., and Matallín, J.C. (2005). Evolución y perspectivas de los planes y fondos de pensiones en España. *Análisis Financiero*, 98, 28-38. Retrieved April 22, 2017 from <https://dialnet.unirioja.es/ejemplar/123649>.
- Ferruz, L., Vicente, L. and Andreu, L. (2007). Performance persistence of Spanish pension funds: The best winners and losers usually repeat. *The Geneva Papers on Risk and Insurance Issues and Practice*, 32(4), 583-594.
- Fuentes, I. (2016). Evolución reciente de los planes y fondos de pensiones en España. *Boletín económico del Banco de España*, 53-61.
- Galán, R. and del Diego, O. (2014, March 3), *World Finance*. Retrieved March 13, 2017 from <http://www.worldfinance.com/wealth-management/intense-reforms-shake-spanish-pensions-ibercaja-responds>.
- García, Y. and García, J. (2006). Análisis conceptual y evolutivo de los planes de pensiones en España. *Gaceta Laboral*, 12(2), 187-215.
- General Directorate for insurance and pension funds (2015). Informe Estadístico de Instrumentos de Previsión Social Complementaria. Available at <https://www.dgsfp.mineco.es/sector/documentos/Informes%202015/INFORME%20SECTOR%202015.pdf>.

- Goetzmann, W.N. and Ibbotson, R.G. (1994). Do winners repeat? *Journal of Portfolio Management*, 9-18.
- Grinblatt, M. and Titman, S. (1994). A study of monthly mutual fund returns and performance evaluation techniques. *Journal of Financial and Quantitative Analysis*, 29(3), 419-444.
- Hendricks, D. Patel, J. and Zeckhauser, R. (1993). Hot hands in mutual funds: short run persistence of relative performance, 1974-88. *Journal of Finance*, 48(1), 93-130.
- INVERCO (2008). Características generales de los planes y fondos de pensiones. Available at <http://www.inverco.es/28/32/92>.
- INVERCO (2017). Available at <http://www.inverco.es/28/29/33>.
- INVESTOPEDIA (2017). Available at <http://www.investopedia.com/>
- Ippolito, R.A. (1989). Efficiency with costly information: a study of mutual fund performance 1965-1984. *The Quarterly Journal of Economics*, 1-24.
- Jensen, M.C. (1968). The performance of mutual funds in the period 1945-1964. *Journal of Finance*, 23(2), 389-415.
- Jimeno, J. F. (2002). Demografía, empleo, salarios y pensiones. *Fedea*.
- Malkiel, B.G. (1995). Returns from investing in equity mutual funds from 1971 to 1991. *Journal of Finance*, 50(2), 549-572.
- Martí, C.P. and Matallín, J.C. (2008). Spanish pension plans performance and persistence. Available at SSRN <https://10.2139/ssrn.1100685>.
- Martí, C.P., Matallín, J.C. and Fernández, M.A. (2007): Análisis de las variables que determinan las comisiones en los planes de pensiones. *Revista de Economía Financiera*, 11, 38-63.
- Mittelstaedt, H.F. and Olsen, J.C. (2003). An empirical analysis of the investment performance of the Chilean pension system. *Journal of Pension Economics and Finance*, 2(1), 7-24.
- Montero, M. (2000). Estructura demográfica y sistema de pensiones. Un análisis de equilibrio general aplicado a la economía española. *Investigaciones Económicas*, 24(2), 297-327.
- Muga L. and Santamaria R. (2010). Market penetration strategies and the fee-performance relationship: the case of Spanish money mutual funds. *The Service Industries Journal*, 30(9), 1529-1547.
- Sharpe, W. (1966). Mutual fund performance. *Journal of Business*, 39(1), 7-9.
- Thomas, A. and Tonks, I. (2001). Equity performance of segregated pension funds in the UK. *Journal of Asset Management*, 1(4), 321-343.

- Tonks, I. (2005). Performance persistence of pension-fund managers. *Journal of Business*, 78, 1917-1942 Available at <http://www.jstor.org/stable/10.1086/431448>.
- Treynor, J.L. (1965). How to rate management of of investment funds. *Harvard Business Review*, 43, 63-75
- Treynor J.L. and Mazuy, K. (1966). Can mutual funds outguess the market? *Harvard Business Review*, 44, 131-136.
- Vidal, J (2016). Spanish mutual funds: short-term performance and market timing. Available at SSRN: <https://ssrn.com/abstract=2737272> or <http://dx.doi.org/10.2139/ssrn.2737272>.
- Vidal, C. and Dominguez, I. (2006). The Spanish pension system: issues of introducing NDCs. *Pension reform*, 611-637.
- Xiaohong, H. and Mahieu, R. (2010). Performance persistence of Dutch pension funds. Available at <https://ssrn.com/abstract=1094704> or <http://dx.doi.org/10.2139/ssrn.1094704>.